HL2001 Breakout Session

- Accomplishments (WOW!!):
  - ✓ Unprecedented sampling of 4 TCs (Chantal, Erin, Gabrielle, Humberto). Landfall data in Gabrielle.
- Opportunities for Collaborative Analysis
  - ✓ Chantal - Great QPE data in very wet storm.
  - ✓ Erin - Opportunity for 3-D analysis and Data Assimilation (DA). Best remote sensing data.
  - ✓ Gabrielle - Excellent PBL data with GPS sonde coverage and remote sensing.
  - ✓ Humberto - best opportunity for 3-D analyses and DA over 3 days. Provides observational database for development of next-generation high-resolution TC numerical models.

HL2001 Breakout Session

- Where do we go in the future?
  - ✓ HL2001 analyses focus on TC intensity change, and QPF. Feedback on USWRP research objectives and operational issues. How can these analyses be transitioned to operations?
  - ✓ How do we transition NASA's research instruments into operational tools (i.e., MTP)?
  - ✓ Need to link observations with modeling through DA. How can we facilitate that?
  - ✓ How can we lubricate the research process to complete HL2001 analyses? If NOAA is focused on operational transition (JHT), who can support this research. Need to work with USWRP more ONR and NSF on support.

HL2001 Breakout Session

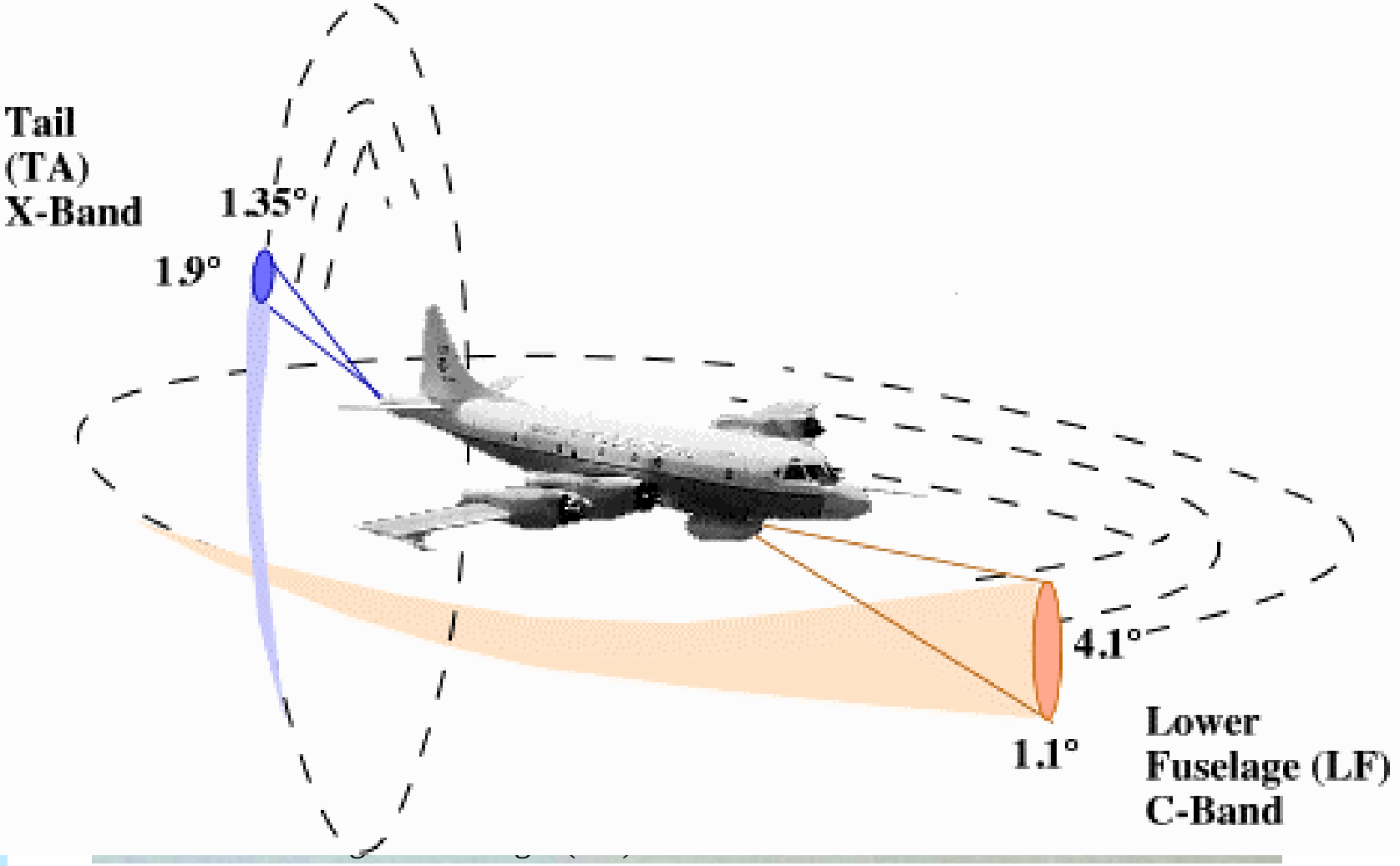
- Action Items?
  - ✓ Need to foster and facilitate collaboration of operational models with HL2001 research particularly in DA for TCs. Do we need a workshop or special session in future?
  - ✓ Need to convince NASA on the need for their expertise in the area of collaborative research (water cycle/precipitation). Need to address this at the AA level of NOAA, ONR, NASA and USWRP Lead Scientist.
  - ✓ Need to work with USWRP, ONR, NSF on support for research with HL2001 data sets to leverage on the NASA and NOAA investments.

HL2001/CAMEX-4
NOAA Airborne Radar Data

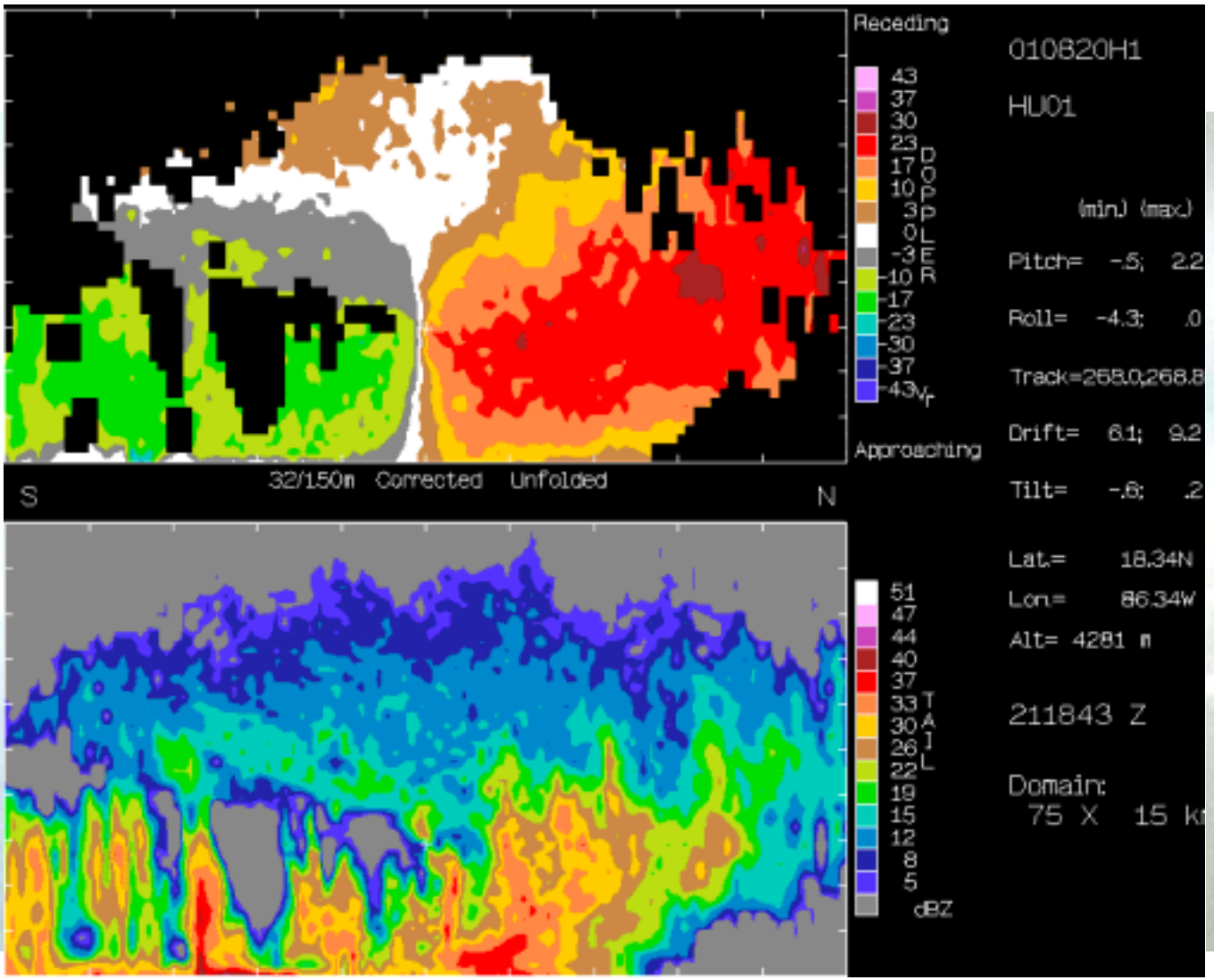
Frank Marks
NOAA/AOML, Hurricane Research Division

- Data Sets/Experiments
  - TS Chantal - 20 August QPE - N42RF, DC-8, ER-2
  - Hurricane Erin - 10 September Surveillance - N42RF, ER-2, DC-8
  - Hurricane Gabrielle - 15-16 September QPE - N42RF, ER-2, DC-8
  - Hurricane Humberto - 22-24 September COVES - N43RF, N42RF, ER-2, DC-8

NOAA Airborne Radars

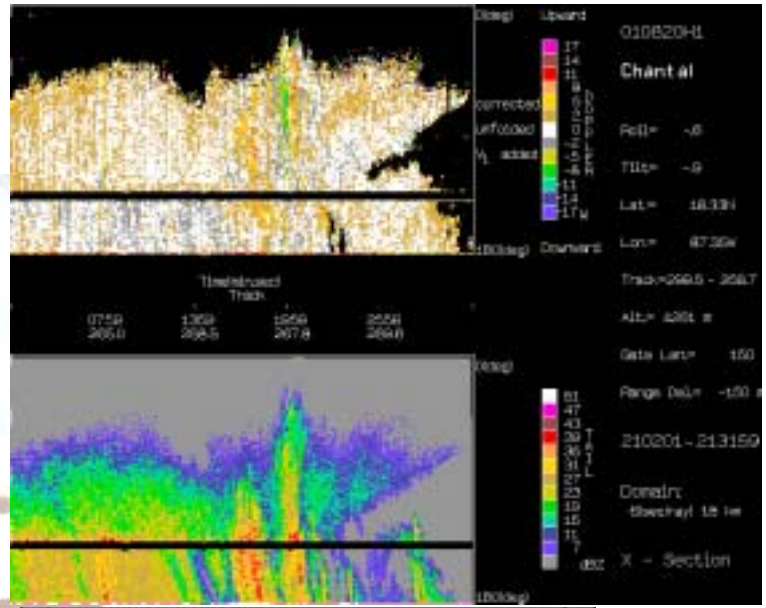


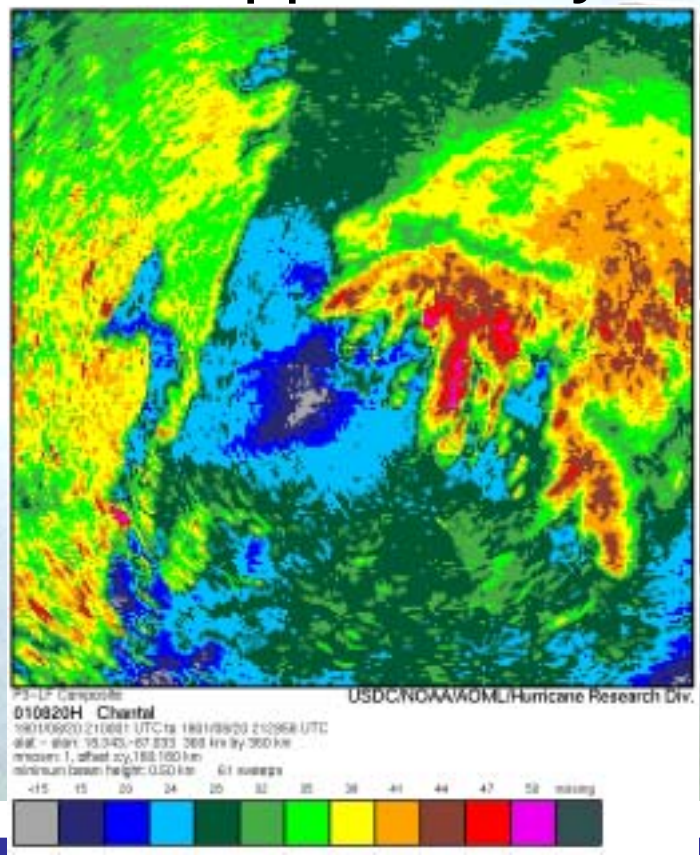
NOAA Airborne Radars

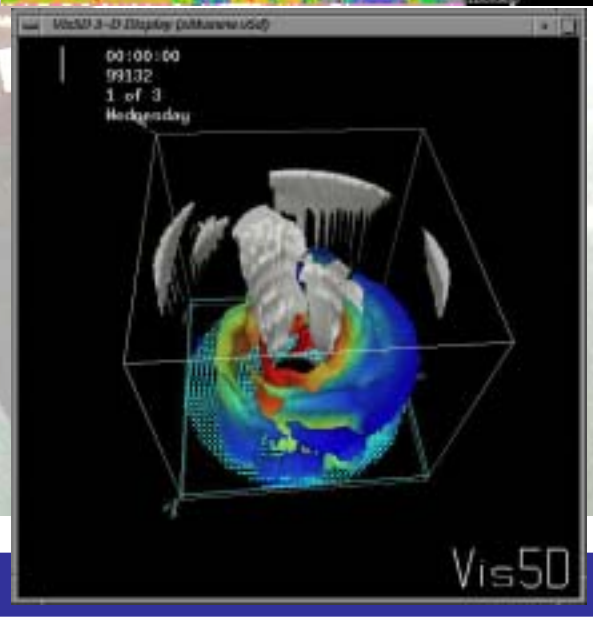


NOAA Airborne Radars

- LF Radar composites
- TA VI
- 3-D Doppler analysis





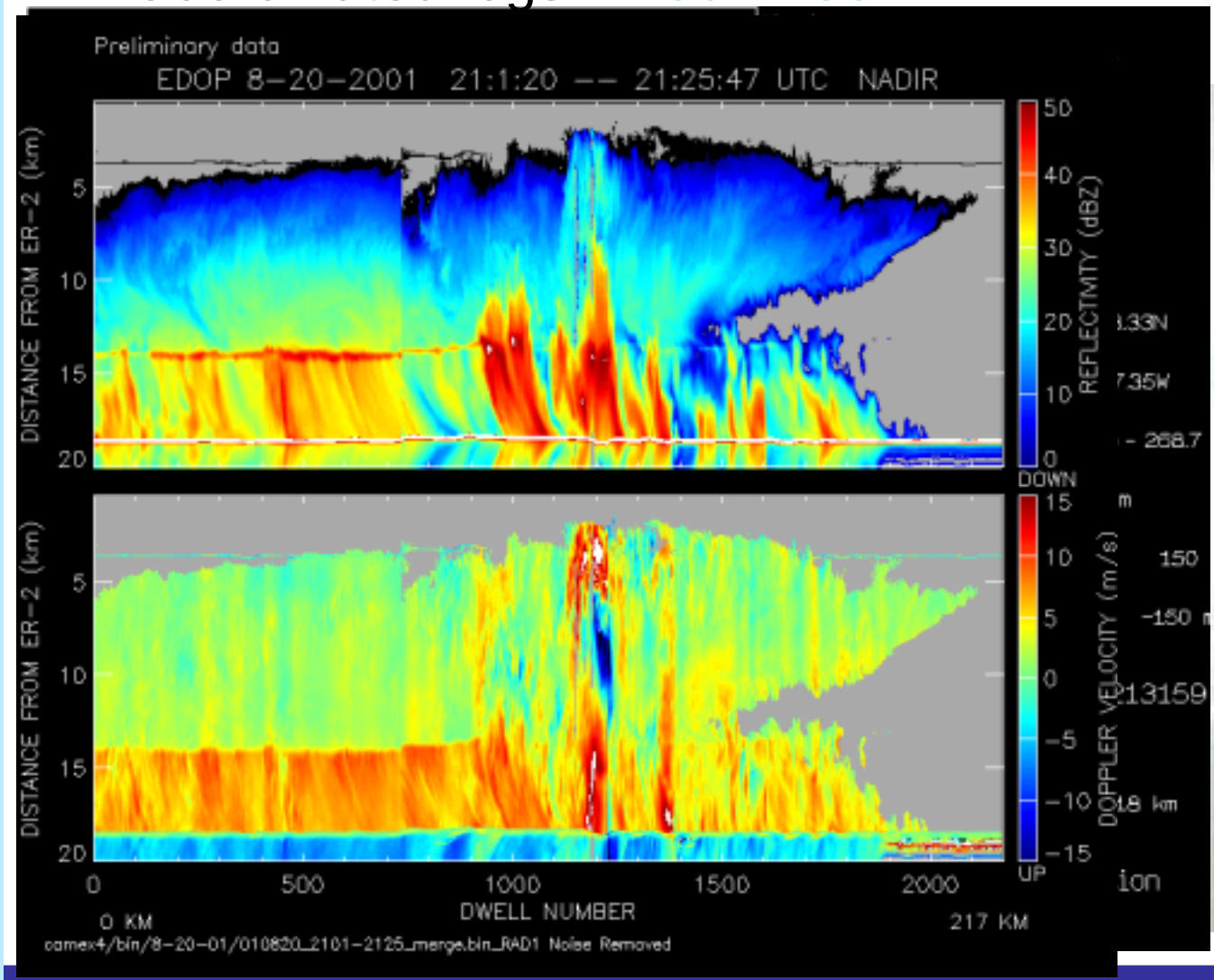


Chantal 20010820

- Coordinated legs
  - 2140-2209 SW-NE

Chantal 20010820

- Coordinated legs: 2100-2136 E-W



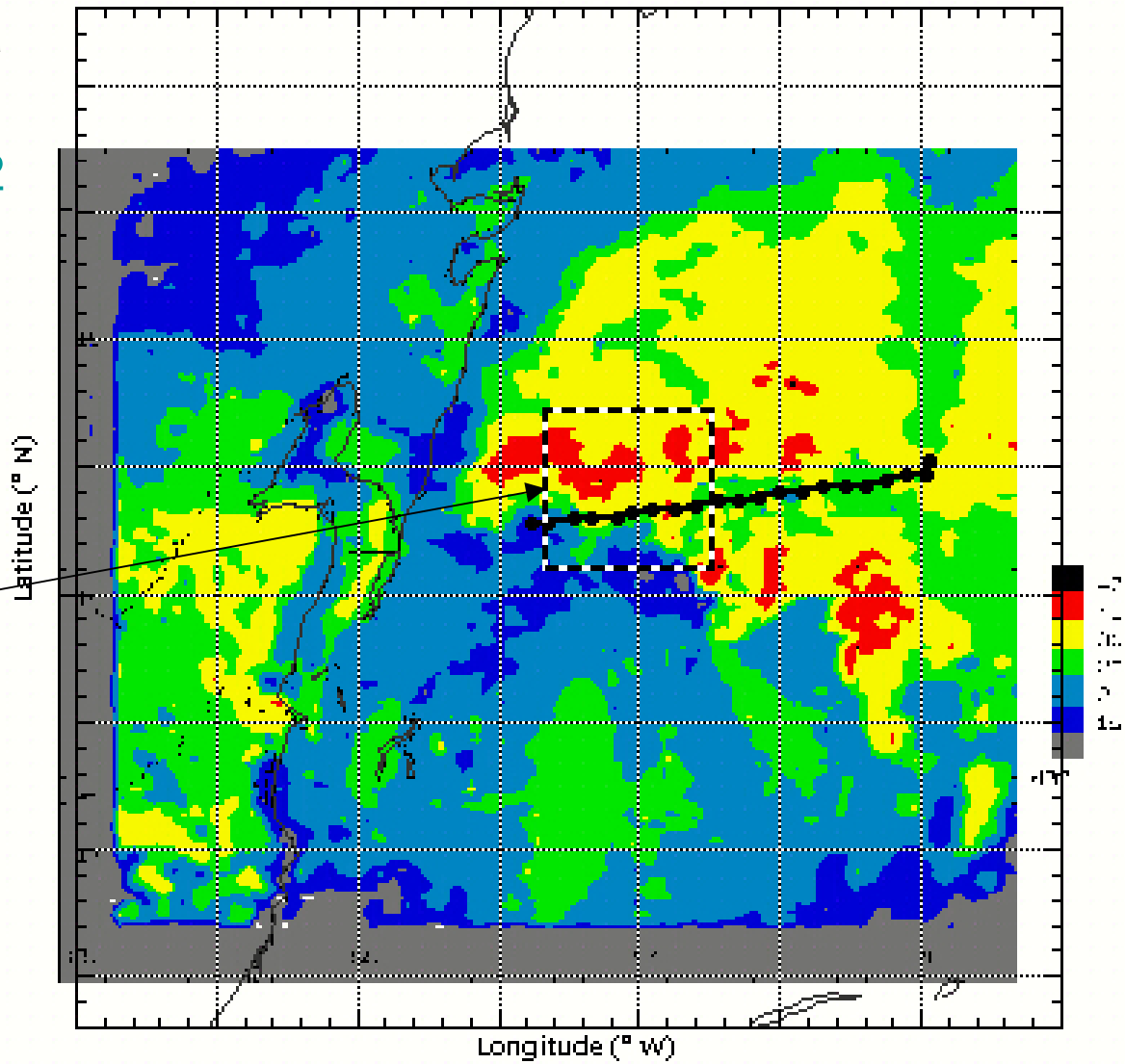
TA VI

EDOP VI

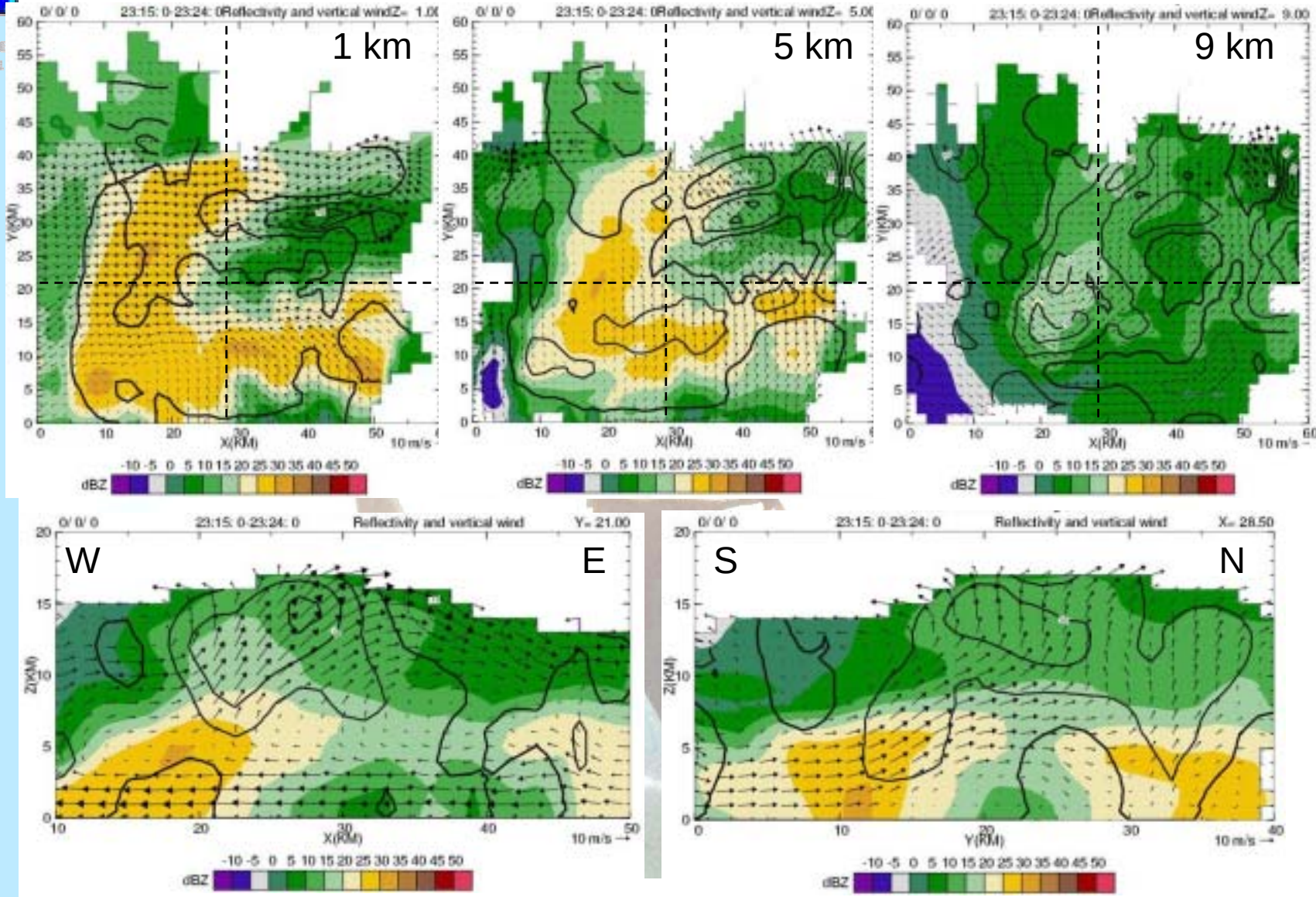
Chantal 20010820

- Coordinated legs
  - 2322-2342 NE-SW

3-D Doppler analysis domain

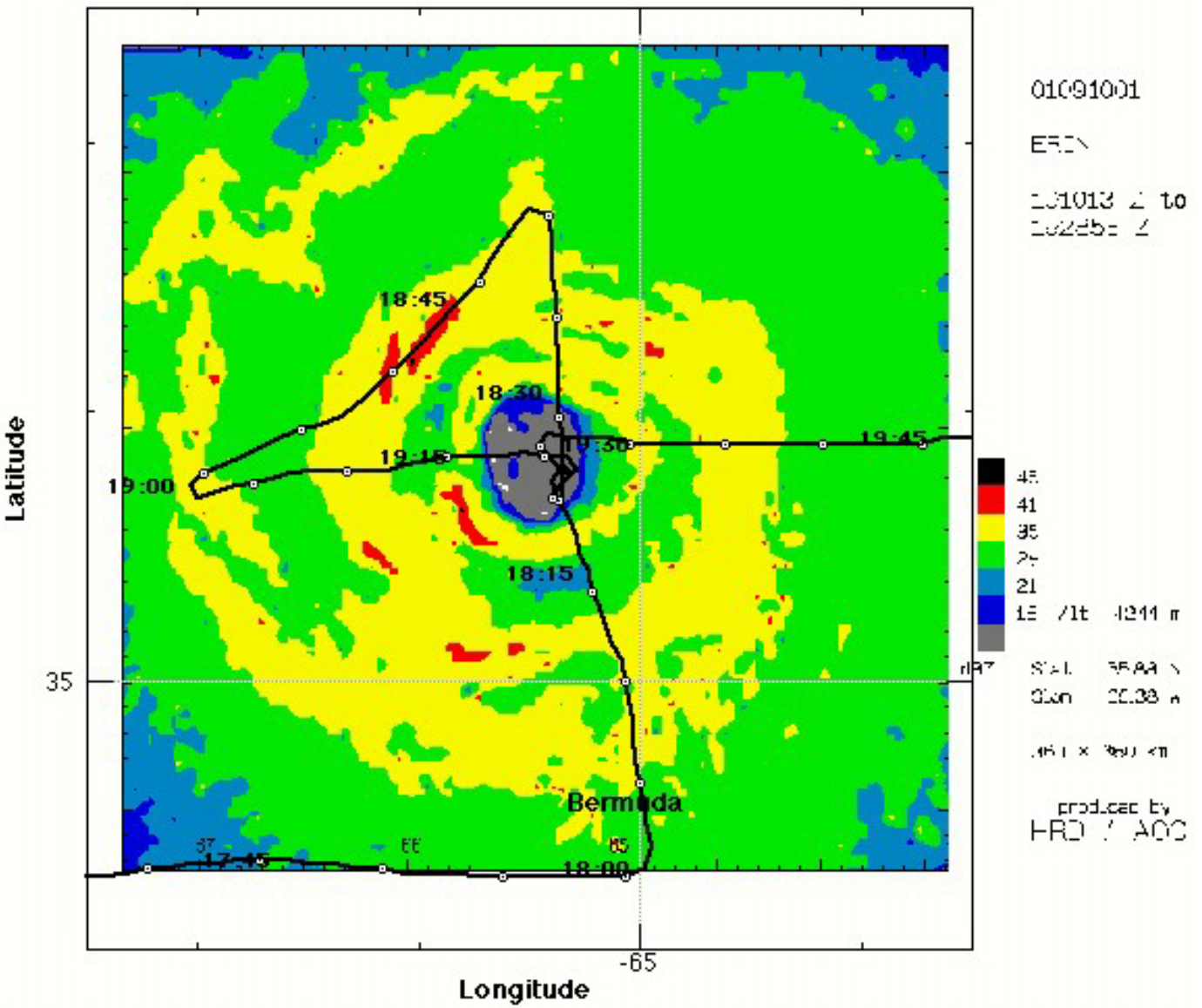


Chantal 20010820



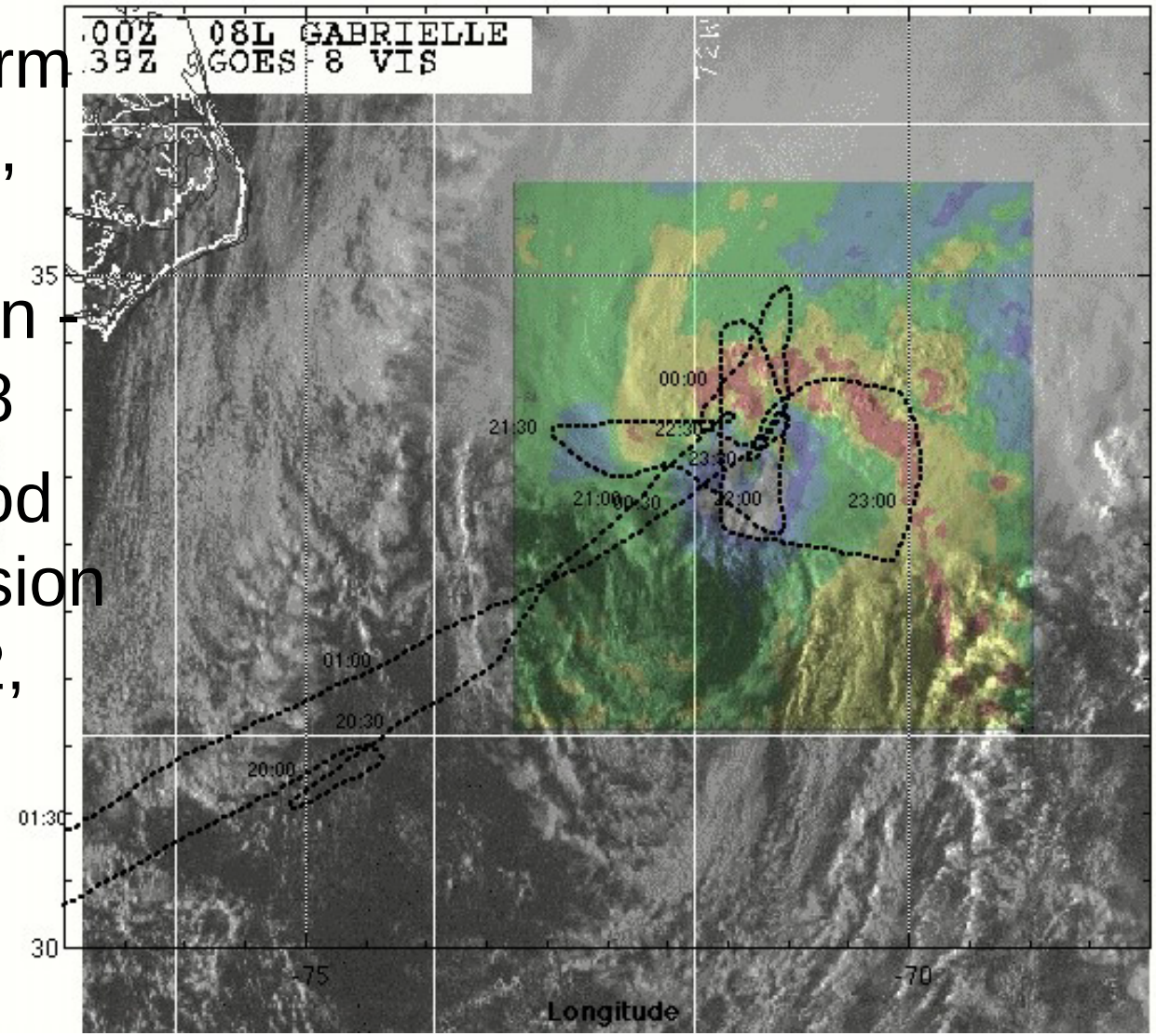
Erin 20010910

- Fligh
- ER-2
- 1 leg over
  - 19 GF in ED AM



Gabrielle 20010915-16

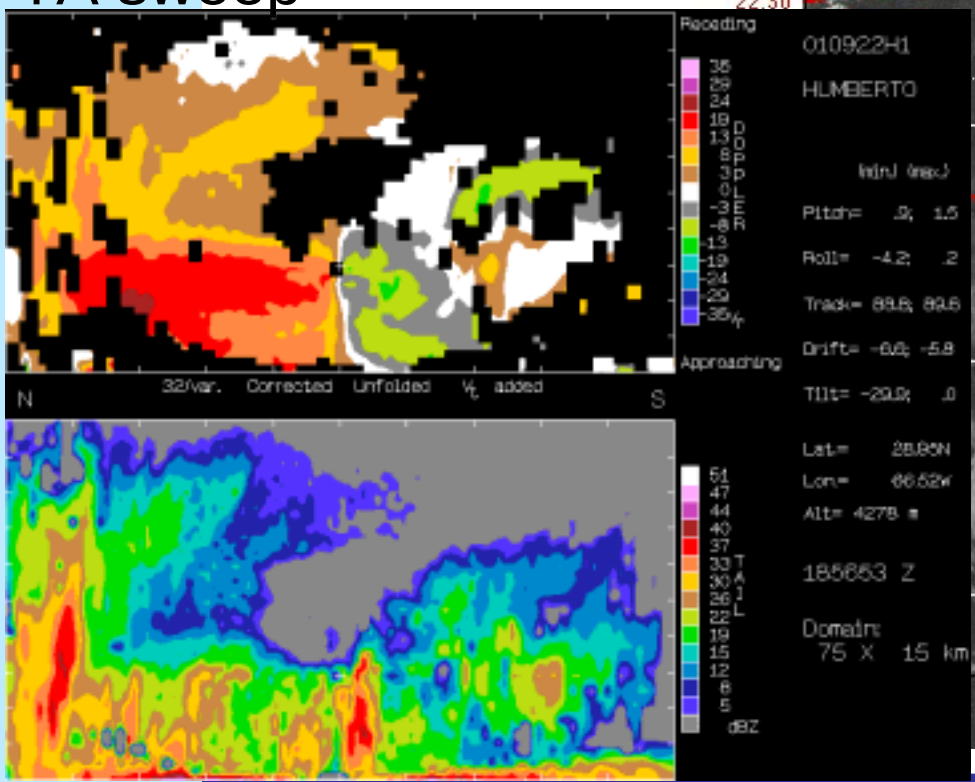
- 09/15 storm reforming, little convection - only DC-8
- 09/16 good QPE mission with ER-2, no DC-8

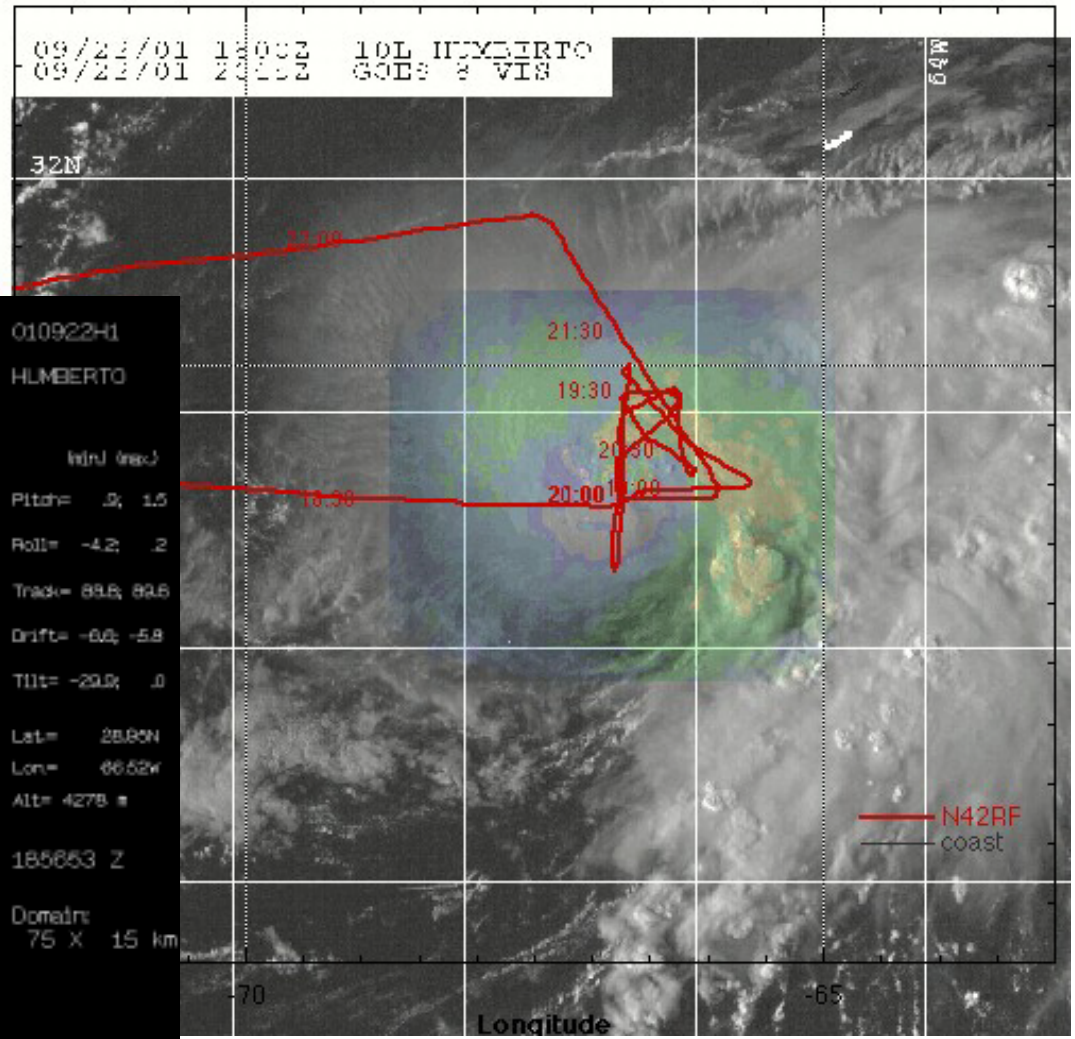


Humberto 20010922

- 9/22: QPE N42RF, DC-8, ER-2

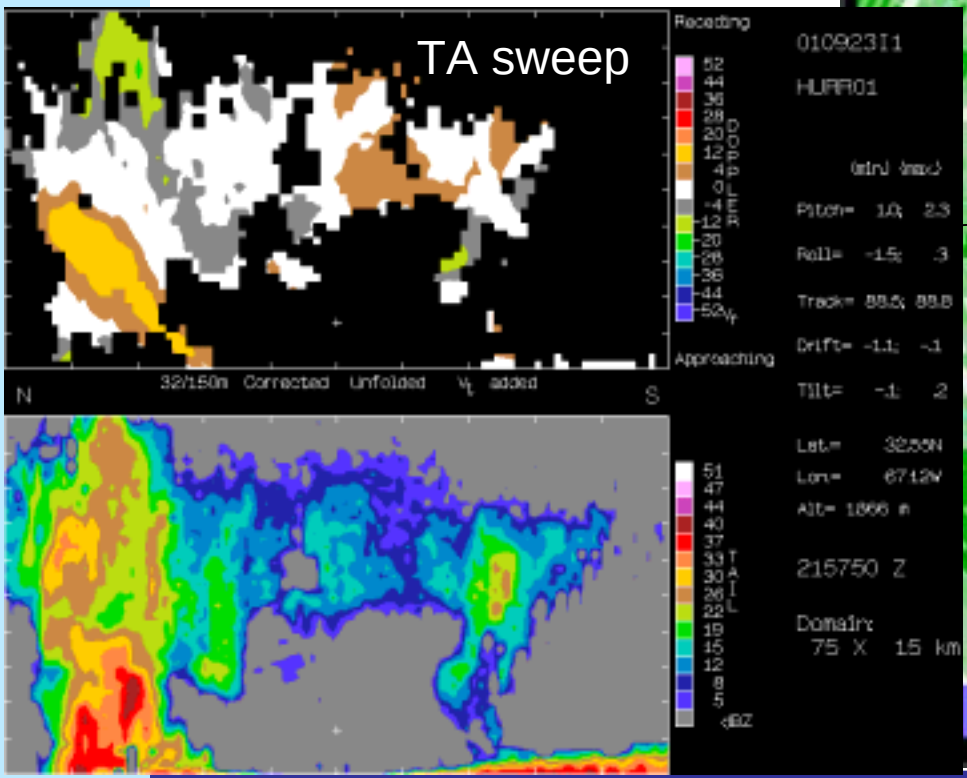
TA sweep

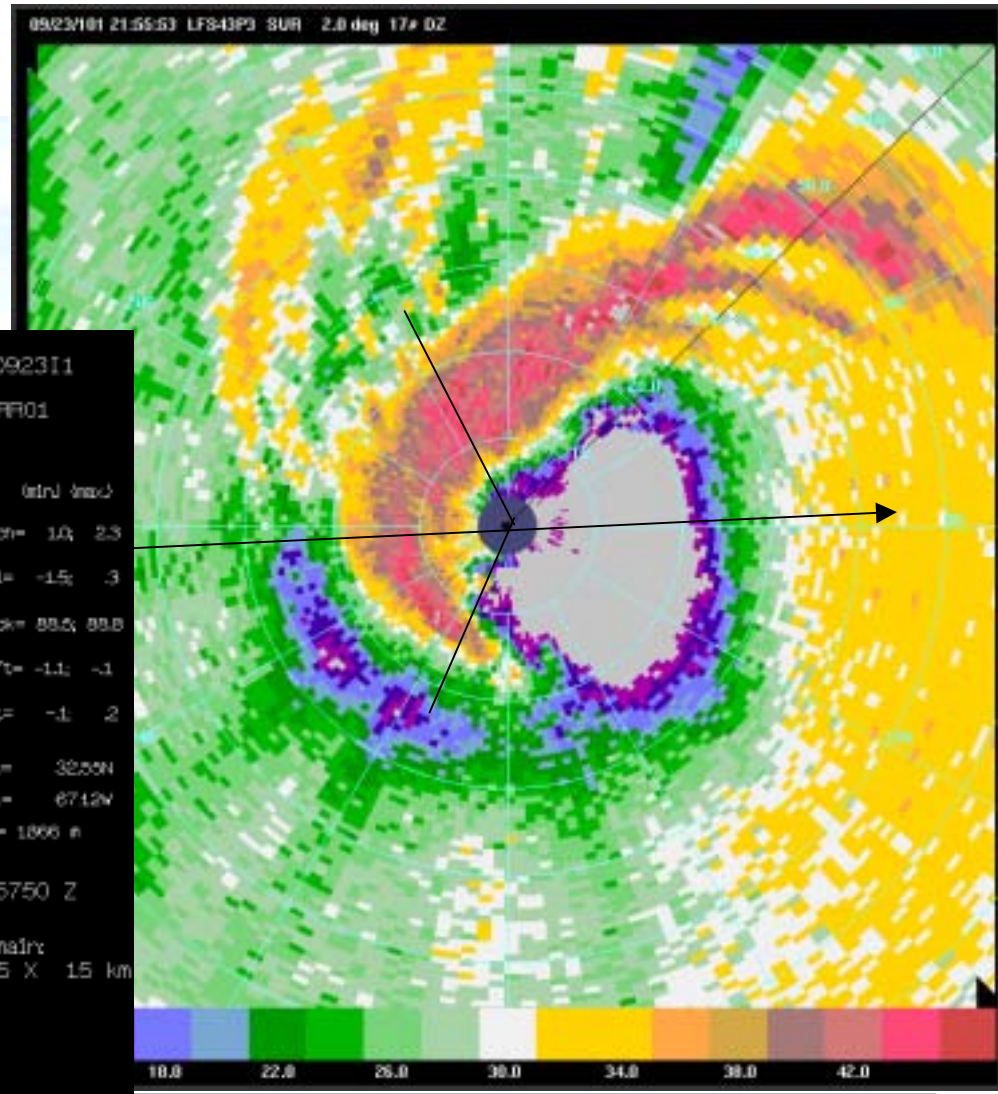




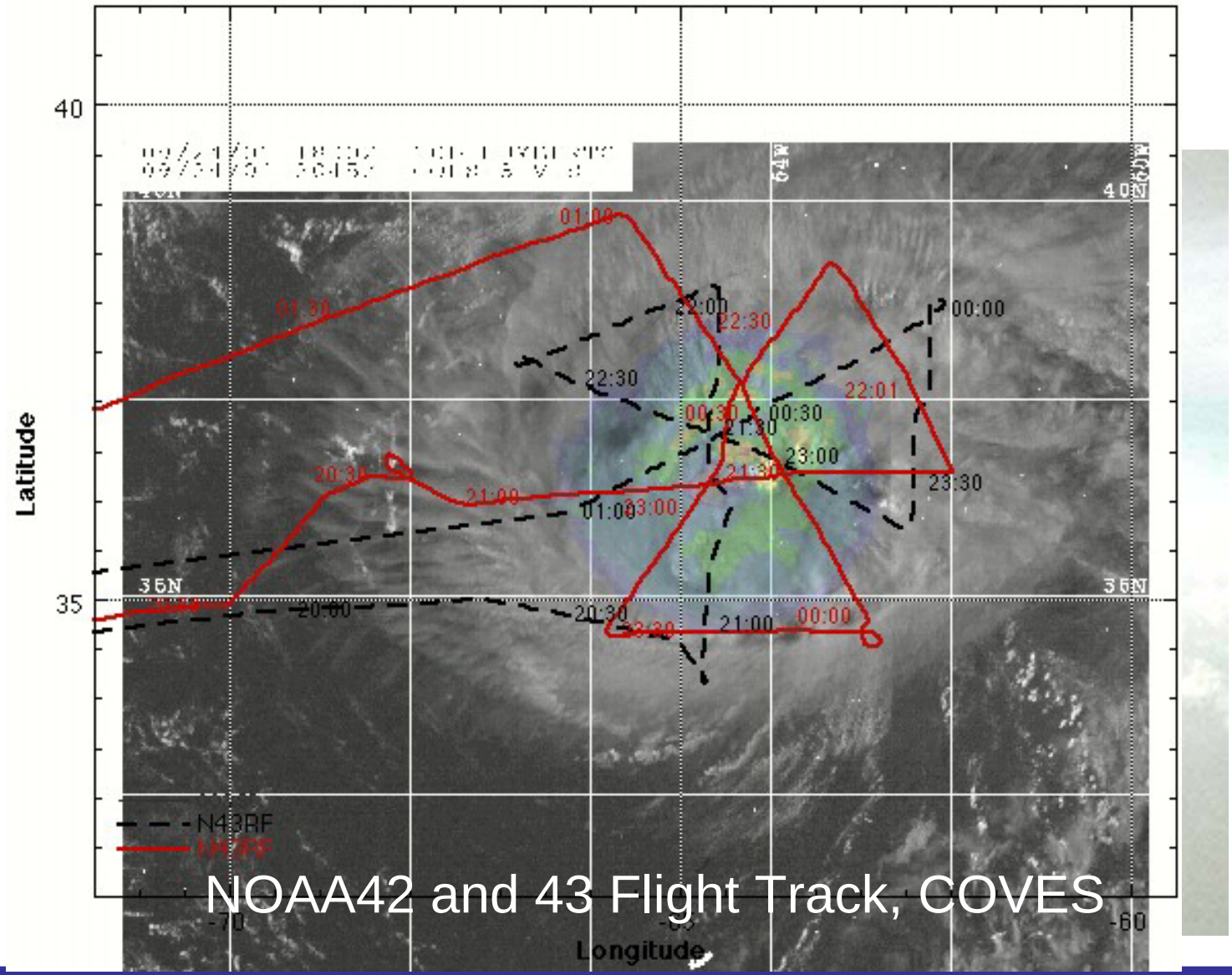
Humberto 20010923

- 9/23: COVES N42RF, N43RF, DC-8, ER-2, G-IV





Humberto 20010924

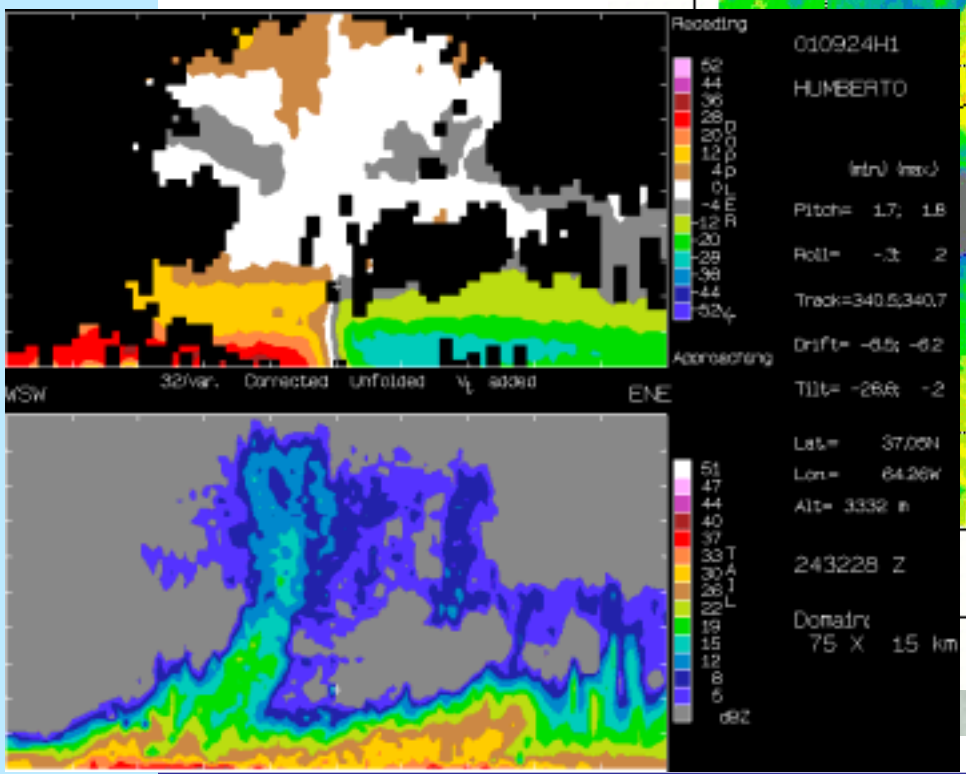


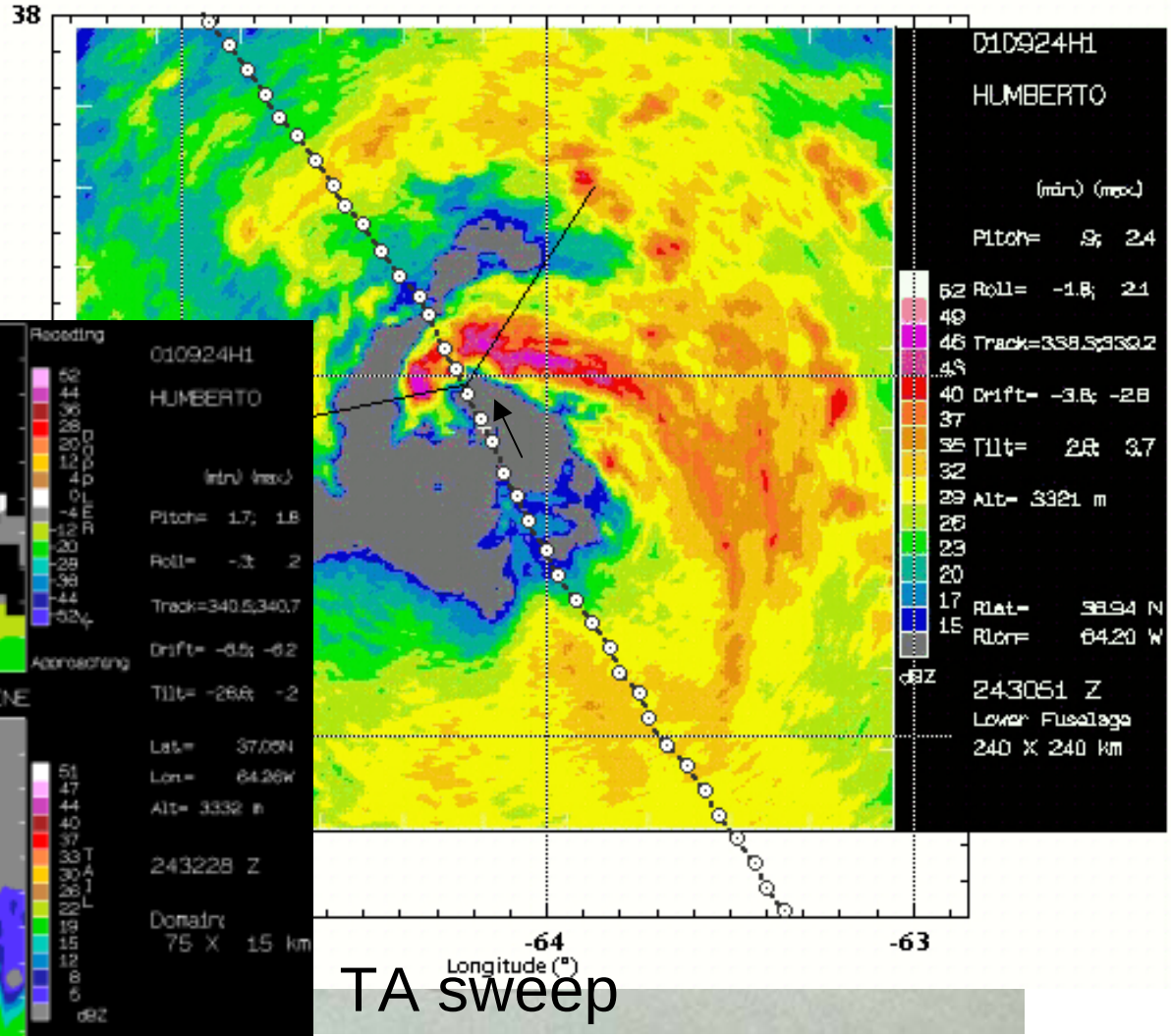
NOAA42 and 43 Flight Track, COVES

Humberto 20010924

Humberto 20010924

LF and flight track





TA sweep

Opportunities for Collaboration

- Data Sets/Experiments
  - Chantal - good VI intercomparison with EDOP in sheared storm.
  - Erin - Good VI intercomparison with EDOP in mature hurricane, opportunity for 3-D Doppler analysis to put GPS sondes in context and for DA
  - Gabrielle - 3-D Doppler analysis on 16 Sept.
  - Humberto - best opportunity for 3-D Doppler analyses to put GPS sondes in context and for DA in numerical models. Also VI intercomparison with EDOP and PR-2

USWRP HL2001 Overview

Frank Marks
NOAA/HRD

For information about HL2001, visit:
http://www.aoml.noaa.gov/hrd/HFP2001/

For more information on NASA's CAMEX-4 experiment, visit:
http://camex.msfc.nasa.gov/

U.S. Weather Research Program
Hurricane Landfall Experiment 2001

WHO

Canada

Objectives

- Main objectives of HL2001 were:
  - ✓ capture 2 snapshots of a TC, mapping storm structure out to 1000 km, from top of troposphere to 200 m into ocean, for use in studies and modeling of processes related to intensification (or weakening);
  - ✓ collect observations of storm structure, particularly microphysics, and dynamics, especially near landfall;
  - ✓ collect observations useful in studies of storm motion, especially near landfall; and
  - ✓ collect observations useful in studies of extra-tropical transition.

Experiments

- NOAA and CAMEX-4 scientists designed 5 experiments:
  - ✓ Coordinated Observations of Vortex Evolution and Structure (COVES) Experiment: Designed to address the first scientific objective
  - ✓ Extended Cyclone Dynamics/Quantitative Precipitation Estimation Experiment (XCDX/QPE)
  - ✓ TC Wind Fields Near Landfall Experiment
  - ✓ TC Surveillance Experiment
  - ✓ Extratropical Transition Experiment

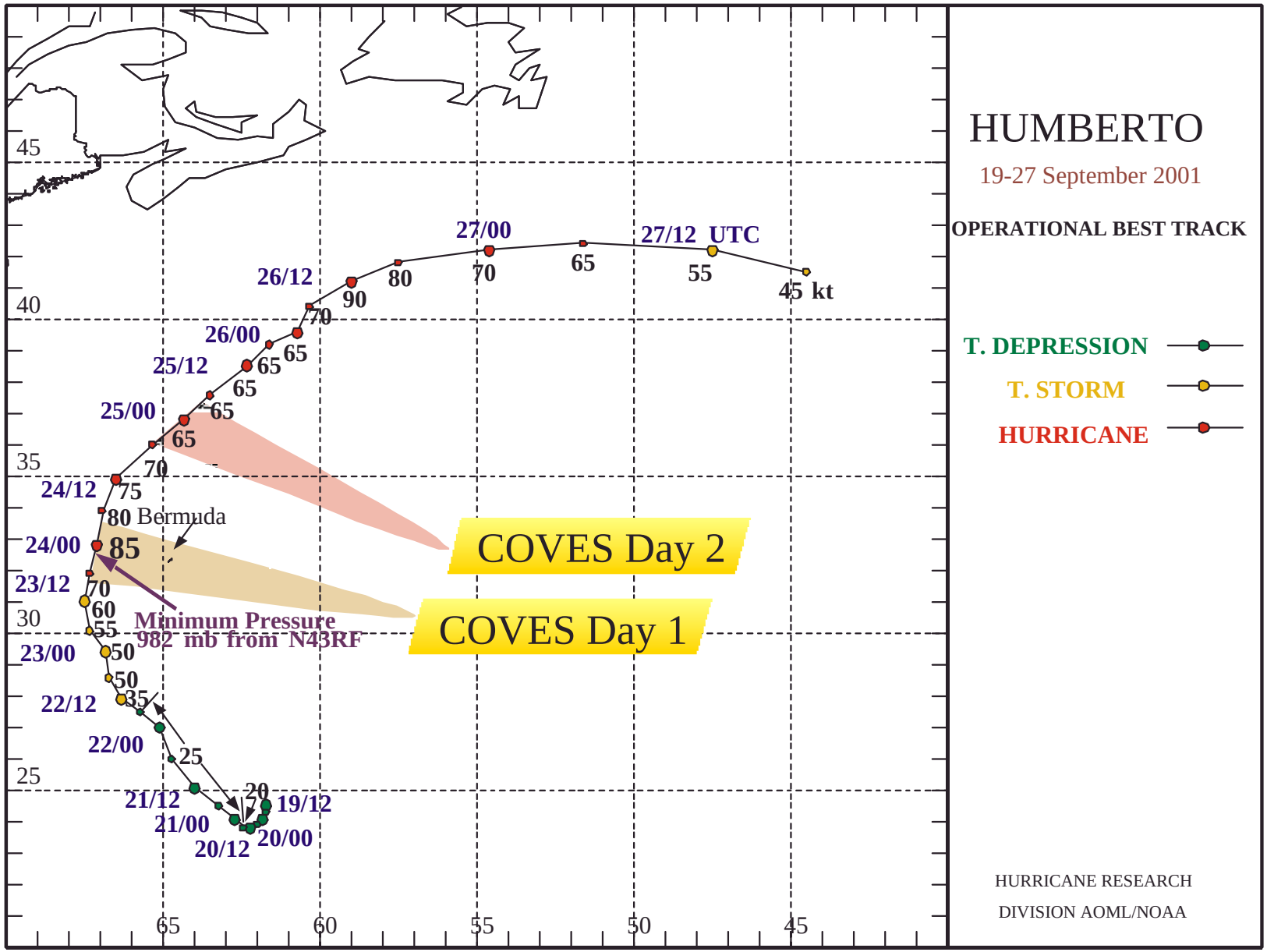
Opportunities

- 6 TCs sampled (Barry, Chantal, Erin, Gabrielle, Humberto, and Michelle), 4 with CAMEX-4 (Chantal, Erin, Gabrielle, and Humberto).
- Also one landfall opportunity for ground-based mobile facilities as TS Gabrielle struck SW Florida.
- N42RF and NASA aircraft flew 4 missions in support of KAMP in vicinity of NASA ground-based instruments near Key West, FL.
- No Aerosonde flights completed into TCs.

Accomplishments

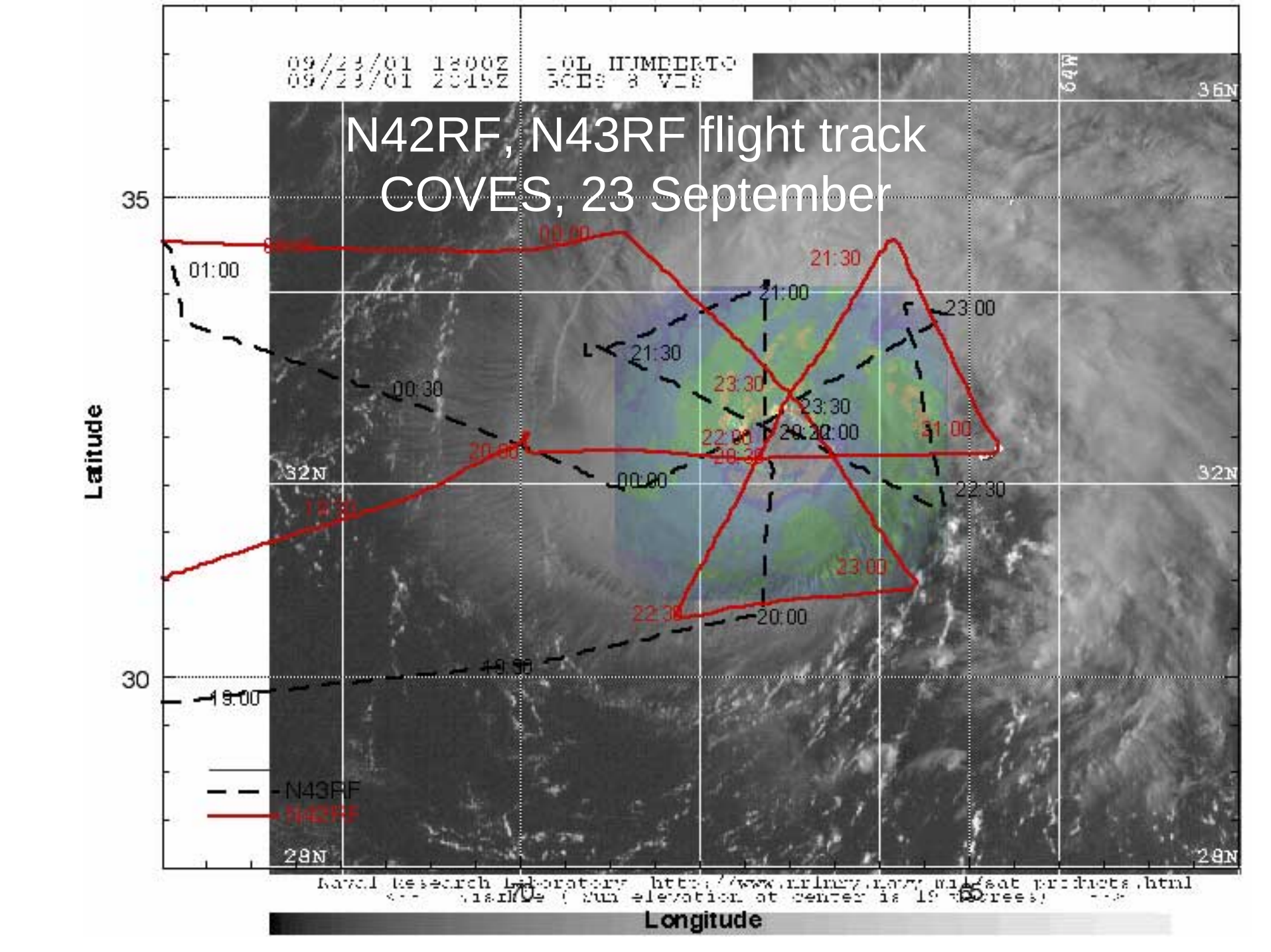
- Complete 3-D mapping of Hurricane Humberto on 22-24 September 2001. Data set provides observational database for development of next-generation high-resolution TC numerical models.
- Highlights:
  - Humberto intensified to TS on 9/22, to CAT 2 strength on 9/23, and back to CAT 1 on 9/24.
  - Atmospheric and oceanic profiling within 1000 km of the storm center from the research aircraft and the G-IV (23 and 24).

NHC operational best track



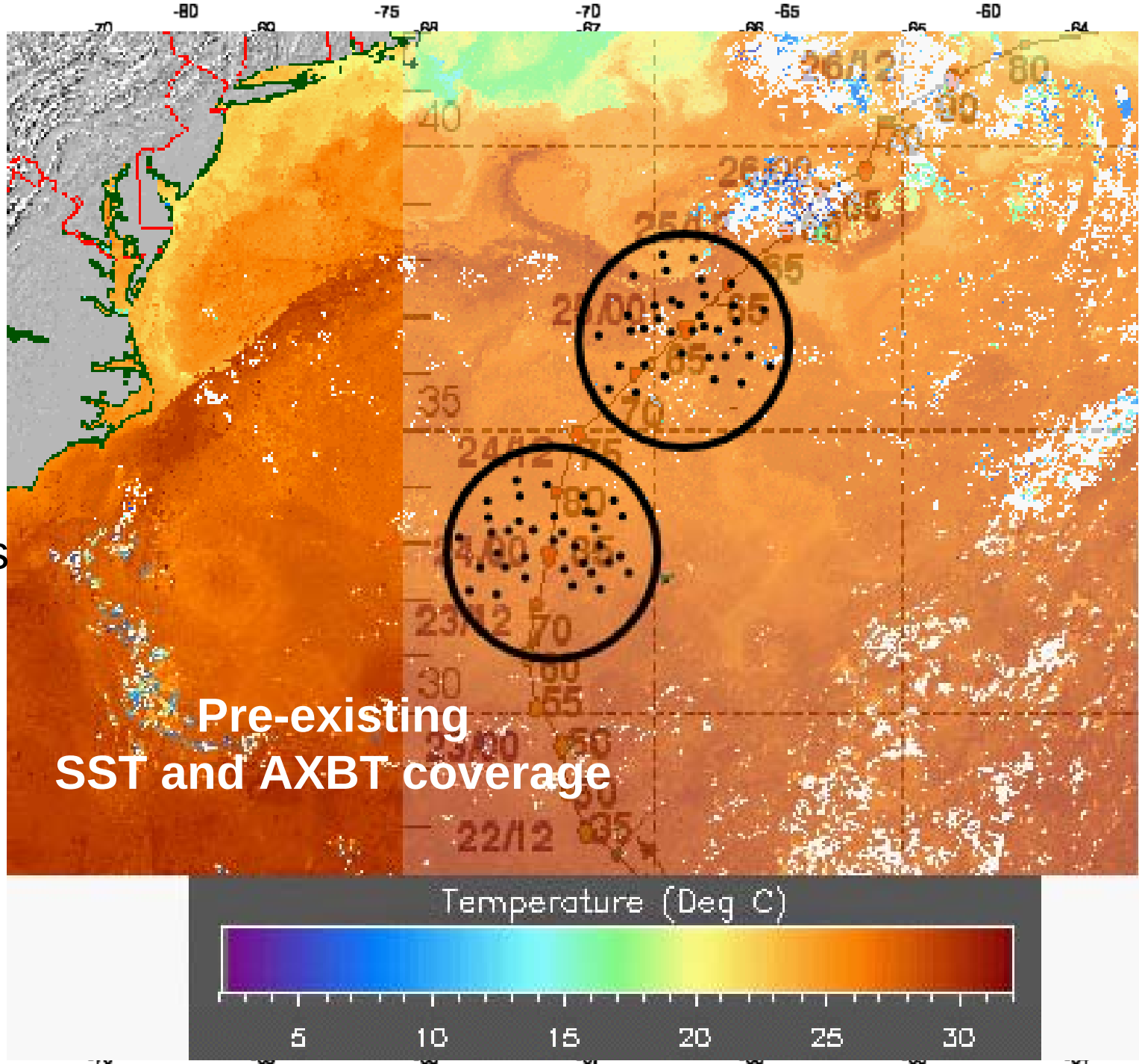
Accomplishments

- 305 GPS sondes and 90 AXBTs deployed, of which 8% of sondes (25) failed to give winds, and 12% of AXBTs (11) failed to give thermal profiles.
- Airborne Dopplers provided 3-D mapping of winds
- Microphysics measurements of precipitation size particles to CN/CCN measurements on N42RF and ice particle measurements on DC-8.
- 2-D wave spectra within 150 km of storm center using the NASA SRA on N43RF.
- Surface wind speed estimates from SFMR on N42RF and N43RF.
- Remote sensed thermal (MTP), moisture (LASE), and aerosol (LASE) fields from DC-8 and ER-2.
- 1st dual-polarized, dual-wavelength (Ka- and Ku-band) radar (PR2) data collected on NASA DC-8.


N42RF, N43RF flight track
COVES, 23 September
09/23/01 1800Z LOL HUMBERTO
09/23/01 2345Z SCES 8 VIS
Latitude
Longitude
35
30
32N
29N
36N
64W
01:00
00:30
00:00
21:30
21:00
23:00
23:30
22:30
20:00
19:00
N43RF
N42RF
Naval Research Laboratory http://www.nrlmry.navy.mil/sat_products.html

Humberto
23 Sept
2001

850 mb
GPS sondes
N42RF,
43RF, and
49RF



April 22, 2002

Accomplishments

- XCDX/QPE in TS Chantal and Hurricane Gabrielle, and Surveillance mission in Hurricane Erin provided data to address rest of HL2001 objectives except (5). Highlights include:
- CN/CCN measurements in TS Chantal, and in Hurricanes Erin, Gabrielle, and Humberto.
- 1st GPS dropsondes from 65,000 ft in TS Chantal and in Hurricanes Erin, and Gabrielle.
- 1st GPS dropsonde in eye of Hurricane Erin from 65,000 ft.
- 1st remote sensed vertical profiles of T through core of TS Chantal and Hurricane Humberto.
- 1st SMART-R C-band Doppler radar data during landfall of TS Gabrielle at Venice, FL.

Opportunities for Collaboration

- Data Sets/Experiments
  - ✓ Chantal - Great QPE data. Strongest DC-8 up.
  - ✓ Erin - Good opportunity for 3-D Doppler analysis to put GPS sondes in context and for DA. Best remote sensing data with good N42RF support.
  - ✓ Gabrielle - Excellent PBL data set on 15th in developing TS with unprecedented GPS sonde coverage (G-IV on 13, 14, 15) and remote sensing (MTP, LASE). 16th has good QPE data.
  - ✓ Humberto - best opportunity for 3-D Doppler analyses to put GPS sondes in context and for DA. Added benefit of MTP vertical temperature profiles from 6-20 km altitude in context of GPS sondes data. Best QPE data on 22nd.